

New Landslide Hazard Maps Demonstrate Value For Big Sur Coast Highway Management Plan

RESULTS: *The GeoResearch Group has partnered with District 5 Planning to direct the California Geological Survey in the delivery of a comprehensive set of GIS-based landslide hazard maps for 75 miles of Route 1 highway corridor along the Big Sur coastline. These maps are being used as key resource documents in the development of the Big Sur Coast Highway Management Plan (CHMP) which is the framework for future coordinated management of this widely treasured coastline.*

Why We Pursued This Research

The Big Sur Coast in California is witness to some of the most dramatic meeting of land and sea anywhere in the world. Highway 1 along the Big Sur Coast has become internationally renowned for the access it provides to this scenic and wondrous place, and was designated as an "All-American Road" under the National Scenic Byways Program in 1996. Not coincidentally, the drama evidenced by the landscape also creates the greatest challenges for maintaining a reliable roadway. Extended reaches of highway 1 cling to the side of steep slopes, traverse broad coastal terraces and span deep canyons leading to the sea. Prone to landslides, Highway 1 undergoes continual repairs. With virtually no detours available, the highway also serves as a lifeline to ocean-side communities and businesses.



Figure 1 – Extent of Big Sur Coast Highway Management Plan.



Figure 2 – Route 1 traversing a slide along Big Sur coastline.

Over the years, controversy has swirled around the Department's response to landslides and its approach to repairs, particularly in regards to potential environmental impacts associated with handling of slide debris. Local communities and regulatory agencies, though supportive of the Department's responsibility to reopen the highway, are also concerned about the extent and longevity of environmental impacts from the repairs. As a proactive response, the Department initiated a planning process to develop the Big Sur Coast Highway Management Plan (CHMP). The CHMP aims to continue the safe and efficient operation of Highway 1 while ensuring the long-term preservation of the intrinsic qualities within the corridor. The CHMP planning process has focused on information sharing and problem solving among diverse stakeholders and aims to outline sustainable management strategies achieved through consensus.

"As with any issue subject to public controversy, it is important to first outline the facts. The work performed by CGS very thoroughly documented the causes, types and characteristics of the landslides .. that put the corridor in its proper geological context in a way that stakeholders could assimilate."

Aileen Loe, Big Sur CHMP Manager

What We Did

Caltrans GeoResearch Group (GRG) initiated the "Corridor-Scale Landslide Hazard Assessment Demonstration" project late in 1999 to develop a standard methodology for integrated archive and display of landslide hazards along a highway corridor to aid in risk assessment. The GRG contracted with the California Geological Survey (CGS) to serve as the technical lead for this project so as to leverage their geology expertise, prior experience, extensive archives, and GIS capabilities. The GRG also established an internal "Project Advisory Panel" (PAP) consisting of potential Caltrans 'end users' to help guide the project. Under the original demonstration project, GIS-based maps were to be prepared at 1:12,000 scale for 147 miles along seven highway corridors having a wide variety of climatological and geological settings. Details of that project are described in the Feb. 2003 volume of Research Notes.

The original demonstration project included mapping of approximately 27 miles of Highway 1 Big Sur coastline. The District 5 geotechnical representative on the PAP quickly recognized their potential for CHMP and coordinated establishment of a partnering arrangement. CHMP agreed to provide funding to extend the study zone by an additional 47 miles. The GRG agreed to develop a contract amendment with CGS, serve as contract manager, and re-prioritize CGS's tasks to meet the urgent needs of the CHMP schedule. In addition to extending the scope of the research project by over 30% to a high-profile application, benefits of this partnering arrangement included efficient delivery of contract services, increased client exposure to the maps, consistent map product standards, and extensive input from CHMP staff into the development of the standards. The CHMP stakeholders have also found particular value in having CGS serve as the technical lead as, they are viewed as being impartial scientists working within a fact-based interpretive framework for hazard identification.

The landslide hazard information (e.g. Fig. 3) is being utilized for the CHMP in a number of ways. Each slide is depicted in a shapefile within the GIS framework and assigned key attributes such as type of slide, activity, and confidence of interpretation. These and other parameters have been integrated into a corridor-wide GIS database that includes additional information such as vegetation communities, sensitive habitats, cultural resources and recreational features. The availability and use of this database utility by Department staff, as well as by regulatory agencies, is expected to help facilitate aspects of environmental planning in the early stages of capital projects and speed authorization of emergency repairs.

More recently, the CHMP has begun work to correlate slide activity, as depicted by the hazard maps, with sediment load estimates being developed under separate research performed by the USGS. Additionally, the CHMP, with assistance from the GRG, is now extending the scope of the CGS slide investigations. In particular, the new CGS work will delineate key slides on Digital Highway Inventory Photography Program (DHIPP) air photos, map detailed features that can affect the stability of the slides, develop typical cross sections and photo documentation, and identify both natural and human-induced activities that affect slide stability. Additionally,

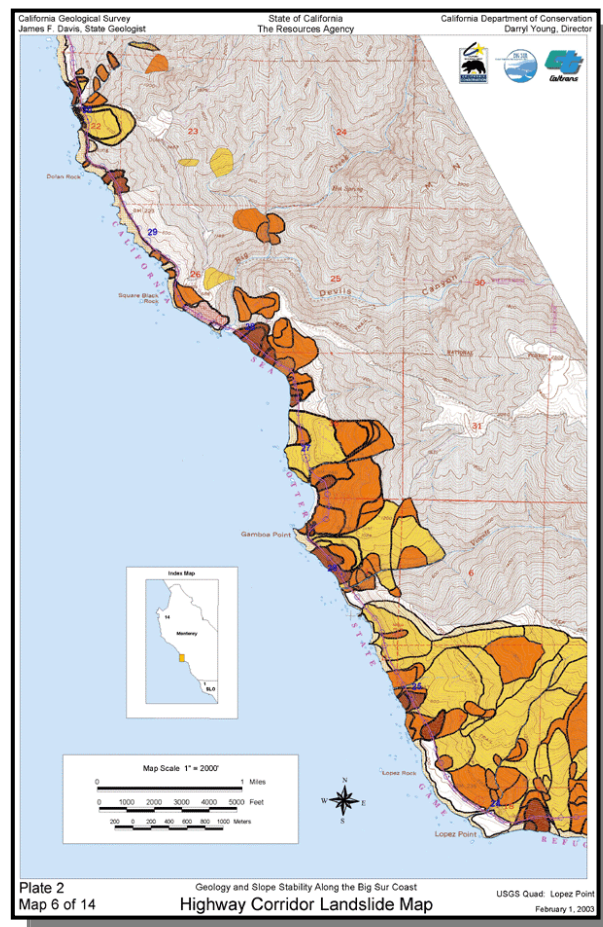


Figure 3 – Typical portion of landslide map for Route 1 Big Sur

the new work will include development of independent recommendations regarding modifications of facilities, improved drainage control, and constraints of maintenance practices, all aimed at improved stability.

The Researchers Recommend

District 5, through the CHMP, has assumed a leadership role in expanding the scope and implementing the "Corridor-Scale Landslide Hazard Maps" developed through GRG contract research. Other Districts are encouraged to contact CHMP staff to investigate potential benefits of funding development of similar maps for slide-prone corridors within their jurisdiction.

For More Information on the Big Sur CHMP

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